Assessment of treatment field isolation during scaling, root planing and rinsing

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Abstract: Aim: Intensive application of highly concentrated antimicrobials during scaling and root planing may be hazardous if swallowed in quantity. This study evaluates two dental isolation systems for fluid leakage in conjunction with a sham treatment of scaling and root planing. Materials and methods: Eight volunteers were randomly assigned to wear a conventional rubber dam (RD) and a combined suction and isolation device (Isolite® system [IL]) alternatively on contralateral maxillary and mandibular quadrants. RD was cut between the canine and the first molar and was fixed on the first molar with a rubber dam clamp and with a tissue adhesive (Histoacryl) on the gingiva. IL was applied as recommended by the manufacturer. Ultrasonic instrumentation with corresponding irrigation water was used for 5 min as sham treatment, i.e. no actual therapy. The irrigation liquid was collected and the difference between the amount of liquid applied and that collected during treatment was determined. The volunteers then reported on their comfort during treatment. Results: Neither of the devices offered complete isolation. Mean leakage with both systems was generally low, i.e. approximately 10% (of the applied irrigant). More leakage was recorded in the maxilla than in the mandible, for both systems. Both devices were deemed moderately comfortable to wear. Conclusion: RD and IL isolated the working field to a similar degree. Since RD represents the highest isolation standard currently available, the use of IL must also be considered sufficient to prevent noxious amounts of antiseptic rinses from leaking into the mouth.

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SUMMARY

Aim: Intensive application of highly concentrated antimicrobials during scaling and root planing may be hazardous if swallowed in quantity. This study evaluates two dental isolation systems for fluid leakage in conjunction with a sham treatment of scaling and root planing.

Materials and methods: Eight volunteers were randomly assigned to wear a conventional rubber dam (RD) and a combined suction and isolation device (IsoLite® system [IL]) alternatively on contralateral maxillary and mandibular quadrants. RD was cut between the canine and the first molar and was fixed on the first molar with a rubber dam clamp and with a tissue adhesive (Histoacryl) on the gingiva. IL was applied as recommended by the manufacturer. Ultrasonic instrumentation with corresponding irrigation water was used for 5 min as sham treatment, i.e. no actual therapy. The irrigation liquid was collected and the difference between the amount of liquid applied and that collected during treatment was determined. The volunteers then reported on their comfort during treatment.

Results: Neither of the devices offered complete isolation. Mean leakage with both systems was generally low, i.e. approximately 10% (of the applied irrigant). More leakage was recorded in the maxilla than in the mandible, for both systems. Both devices were deemed moderately comfortable to wear.

Conclusion: RD and IL isolated the working field to a similar degree. Since RD represents the highest isolation standard currently available, the use of IL must also be considered sufficient to prevent noxious amounts of antiseptic rinses from leaking into the mouth.

Introduction

The treatment of periodontitis is still challenging. Biofilm removal in deep pockets – especially when accessibility and instrumentation is compromised by narrow bone defects or furcations – has been shown to be incomplete (Sherman et al. 1990). Therefore, a plethora of mechanical modalities and physical or chemical adjunct therapies have been introduced to improve clinical outcomes. Among these options, the additional rinsing with antimicrobial substances, e.g. povidone-iodine (PVP-I) or even hypochlorite, has been proven to be an inexpensive and easy way to reduce the biofilm and to reduce the pocket depths (Slots 2002). Hoang (Hoang et al. 2003) showed a reduction of at least 95% of total pathogen load in 44% of periodontal pockets with 6 mm or more pocket depth, 5 weeks post treatment, with a subgingival irrigation of 10% PVP-I solution. Sahrmann and co-workers have shown that the frequent application of 10%-PVP-I solution and gel during SRP enhanced pocket depth reduction in initially deep pockets significantly (Sahrmann et al. 2014). A systematic review by the same group (Sahrmann et al. 2010) confirmed an additional benefit of PVP-I rinse after scaling and root planing for single-rooted teeth, particularly when the treatment was repeated during the healing stage.

Short or long-term exposure to topically applied antiseptics does not induce bacterial resistance and – even more importantly – resistance to antibiotics does not influence the sensitivity of bacteria to PVP-I (Michel & Zäch 1997). Notably in this context, an allergic sensitization to PVP-I seems a very rare finding. Allergy to PVP-I seems not to be based on sensitization to iodine (van Ketel & van den Berg 1990).

A recent study further showed the capability of PVP-I to prevent oral bacteremia when used as a mouth rinse, followed by thorough irrigation of the periodontal pockets (1 minute/site) before and during manual debridement (Sahrmann et al. 2015). However, in order to prevent potential adverse effects through swallowing these therapeutic amounts of PVP-I, an isolation of the operation field by rubber dam (RD) placement has been presented (Sahrmann et al. 2014). The technique involves clamping the rubber dam to the most distal tooth to be isolated and using a tissue glue to fix the dam tightly along the length of the working area to the gingiva and palatal mucosa. Whereas this setup requires some additional chair side time and clinical skills, it has been proven to be clinically effective in protecting patients from swallowing the PVP-I applied.

A combined suction and isolation device was introduced a few years back, but there have been no studies that quantify its effectiveness. This system, the IsoLite system (IL), can be easily mounted on existing suction lines, has a mouth piece which shields the cheek, tongue, lips and throat and has an integrated bite block. Dahlke (Dahlke et al. 2012) reported, that the use of a dental dam with high volume evacuation (HVE) or the IsoLite system significantly reduced spatter as compared to the use of HVE alone. Isolation with a dental dam and HVE or the IsoLite system appeared to aid in the reduction of spatter during operative dental procedures, potentially reducing the aspiration of oral pathogens as well. Alhareky (Alhareky et al. 2014) reported that the IL system was a practical alternative to the RD when treating children between 7 and 16 years of age, because the application and treatment time was shorter and the patients' satisfaction was higher. Collette (Collette et al. 2010) also confirmed only minor discomfort by using IL instead of cotton rolls.

The purpose of this study was to assess the clinical use of RD and IL in a periodontal treatment simulation for its isolation potential, ease of use and subject comfort. To this end, measurements of irrigant water loss, as a surrogate factor for isolating potential against antimicrobial rinsing solutions, were undertaken. We hypothesized that no liquid loss would be observed, that the entire volume of irrigating solution could be collected and that the subjects in this study would tolerate both isolation systems well.

Material and Methods

No subject-related descriptive data was collected and all results obtained from a convenience subject sample were irreversibly blinded. Eight subjects, 4 males and 4 females, gave informed consent to voluntarily participate in the study. They were randomly assigned to wear rubber dam (Ivory, Heraeus Medical, Hanau, Germany) or IsoLite® (IsoLite Systems, Santa Barbara, USA) first on either the maxillary left or right side (and contralateral mandibular quadrant) and then the other device on the remaining contralateral quadrants. A randomization list to determine both the sequence of the isolation systems and the treatment sides was generated on www.random.org. The protocol set forth that all subjects would be treated with both isolation systems, on contralateral sides and jaws for 5 minutes with sham treatment. The sham treatment was performed with a water-cooled ultrasonic scaler (AirFlow Master Piezo, EMS, Nyon, Switzerland). A total of 32 quadrants were treated.

The RD was cut from the canine to the first molar on which it was fixed with a clamp. Then the gingiva was dried by air stream and a tissue glue (Histoacryl, B. Braun Medical, Melsungen, Germany) was used to seal the RD's margins on the buccal and lingual/palatinal aspects to prevent leakage (Fig. 1). The size of the IL-mouthpiece was chosen according to the subject's mouth size and was mounted as recommended by the company (Fig. 2). The examiner was instructed and supervised by the manufacturer's local representative.

Sham treatment always started in the upper jaw and then moved on to the lower jaw. After treatment, all subjects were asked to report on the comfort of wearing either RD or IL, respectively, using a visual analog scale. For this purpose, subjects indicated on a defined scale between 0 as uncomfortable and 10 as comfortable their subjective perception of the isolation system used. In addition, subjects had the possibility to specify the exact reason for discomfort.

The ultrasonic scaler's external water supply bottle was completely filled and weighed before each treatment. Likewise, the unused irrigation water was weighed after the treatment, as was the water from the collection glass, in order to calculate the amount of fluid that was lost, or won, due to leakage of the isolating systems.

Neither RD/IL nor the gingiva or teeth were touched with the instruments or the operator's fingers. The liquid was collected during 5 minutes. The ultrasonic scaler's water container was measured by a digital precision scale (Cucina & Tavola, Migros, Zurich, Switzerland) to the nearest gram before sham treatment started and after its completion.

The dental unit's suction system was modified to collect the liquids generated during the sham treatment, as follows: a break was made in the dental unit's suction line, where a collection glass set inside of an airtight collection bottle was placed. On the subject end of the suction line, either a surgical cannula (Orbis Dental, Münster, Germany) for the RD system or the IL mouthpiece was attached. On the unit side of the modification, the suction line ran between the outer collection

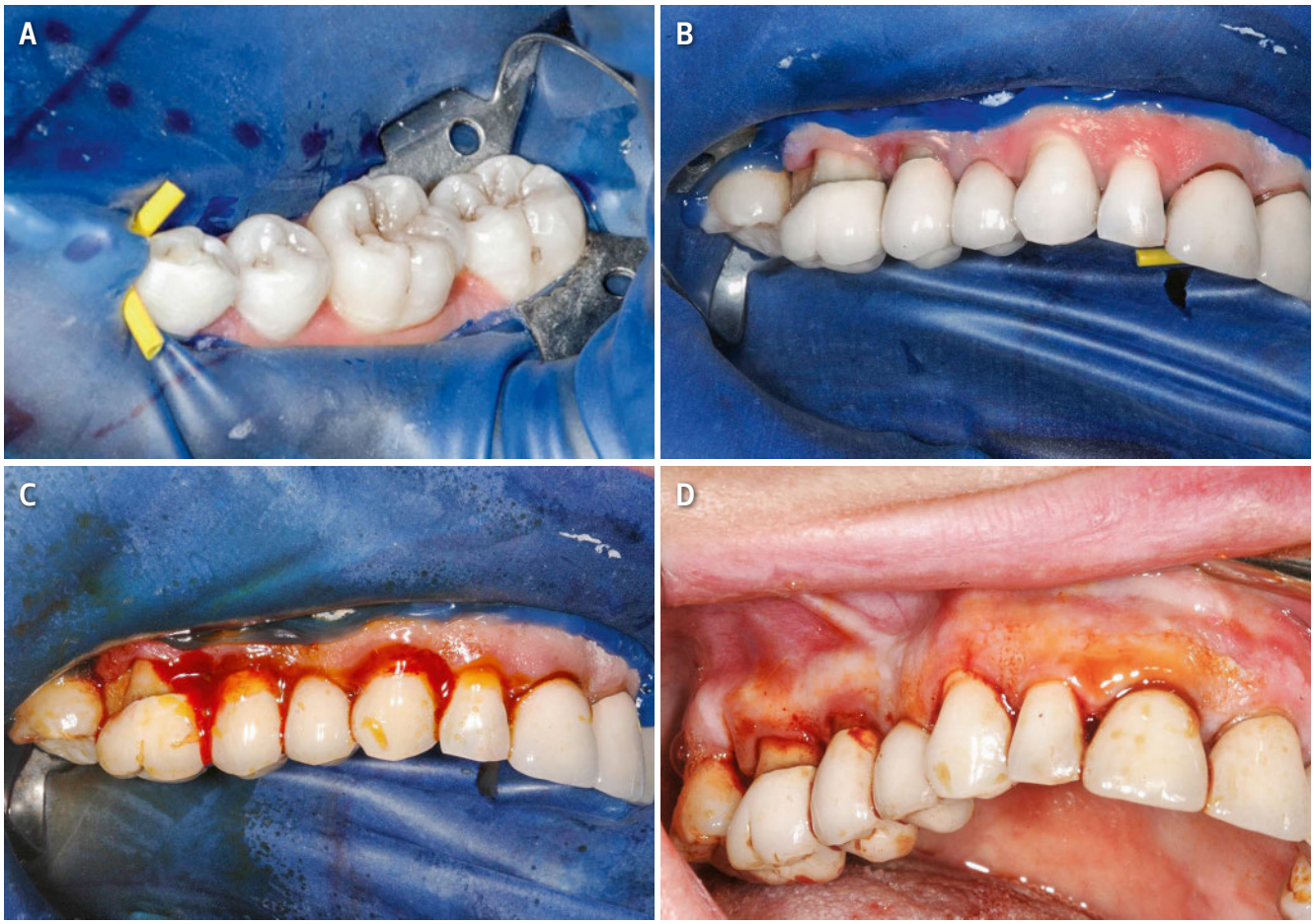

Fig. 1 Representative image of a rubber dam locally glued and fixed on previously air-dried gingiva in a lower left quadrant (A): a clamp fixes the rubber dam on the first molar, whereas a rubber ligament stabilizes the dam in the front. Panels B–D depict the application during another treatment showing the situation before scaling (B; a stabilizing light-curing flowable material was placed to seal the margins), application of a PVP-iodine unguent (C) and after removal of the rubber dam (D).

Fig. 2 Image of the IsoLite mouthpiece with integrated bite block and light source.

bottle and the dental unit. This hose was placed in the collection bottle in such a way that there was no contact with the rinse liquid collected in the separate collection glass inset and therefore excluded any possibility of liquid collected being suctioned away. The differences in weight of the collection glass before and after treatment accounted for the amount of the collected water/saliva. If the weight of the collected water was lower than the weight of the initial water rinse (weight difference of the water container on the ultrasonic device between start and end of shame treatment), the RD or IL was deemed permeable and the subject to have swallowed water. If the weight of the collected liquid was higher than the weight of the initial water rinse, the system was also deemed as permeable (or insufficiently sealed) and to have evacuated saliva as well as irrigant water.

Results

Leakage

Neither of the systems isolated completely (Fig. 3). Generally, more leakage was recorded in the maxilla than in the mandible, but leakage values were generally low. Permeability of the barriers used was found in both directions; irrigation water escaping into the oral cavity and saliva being evacuated from the purported isolation field. In 16 out of 32 quadrants treated, a net-gain of water/saliva was found. In the other 16 quadrants, a liquid loss was recorded; 7 when using RD and 9 when using IL.

During the complete sham treatment, an average of 132 ml of water per jaw and isolating system were used (minimum 89 ml, maximum 164 ml). The lowest percentage of leakage using RD was 2.94% in the mandible, which actually indicates that the system evacuated 4 ml of saliva in addition to the water rinse used during the 5 min of sham treatment. The lowest percentage of leakage using the IL was –1.26% in the upper jaw.

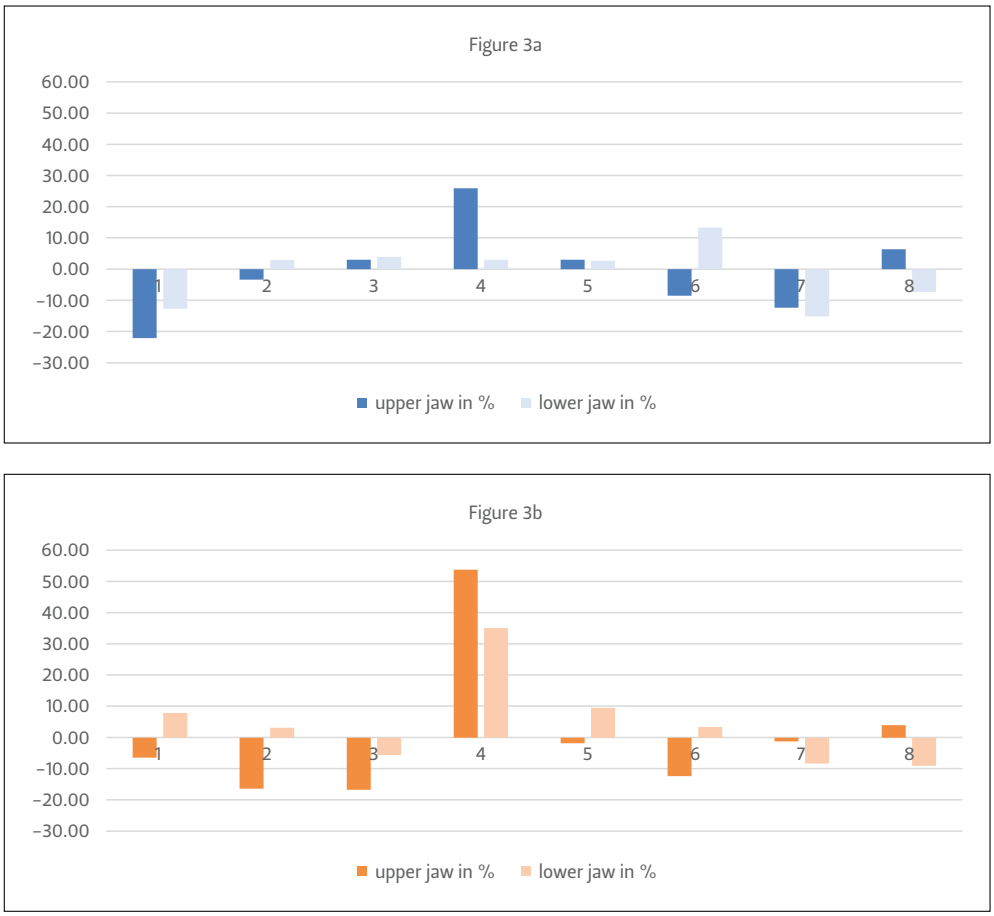

Fig. 3 Leakage values (%) when using rubber dam (Fig. 3a) and the IsoLite system (Fig. 3b) for each individual participant. Positive values indicate a net gain of the measured liquid, which may indicate saliva passage. Negative values represent a net liquid loss, probably due to swallowing.

The maximum amount of water/saliva passing the isolation barriers was 53.77% (equals 57 ml, IL maxilla). Twenty-one out of 32 (65.6%) leakage values were smaller than 10%, 7 leakage values (21.8%) ranged between 10% to 20%, 4 leakage values (12.5%) were more than 20%. The three highest leakage percentage values were measured in the same subject and resulted in a net water/saliva gain.

The mean leakage values for RD, which resulted in water being swallowed, were: –11.92% (–16.75 ml/5 min) for the maxilla and –11.65% (–18.33 ml/5 min) for the mandible. For IL, lower amounts were measured: –8.91% (–11.67 ml/5 min) for the maxilla and –7.74% (–11.33 ml/5 min) for the mandible. The mean leakage for RD accounted for 10.95% (upper jaw), 7.76% (lower jaw) and was therefore less than for IL with 12.78% (upper jaw) and 9.73% (lower jaw).

In this study, the examiner needed more time than in other dental applications to prepare, cut and fix the RD (cutting RD, drying gingiva and sealing the dam with tissue glue).

Patient satisfaction

Both, RB and IL were moderately comfortable to wear, with mean VAS scores of 7.12 for RD and 6.64 for IL. The analysis of the VAS regarding subject satisfaction revealed that there was an even split concerning device preference; 50% of the subjects preferred to be treated with RD, whereas the other 50% preferred to be treated with IL. Individual data for subject satisfaction for upper and lower jaw (VAS) is given in Figure 4. Subjects who preferred treatment with RD criticized IL for triggering their gag reflex. When wearing the IL, some volunteers also complained about tongue dislocation towards the throat and therefore rated the IL as less comfortable than the RD. On the other hand, those subjects who reported to have more wearing comfort with the IL felt the RD was uncomfortable due to the pressure of the RD's clamp on the first molar.

Discussion

Intensive application of highly concentrated antimicrobials during scaling and root planing may be hazardous if swallowed in quantity (Dela Cruz 1987; Lim 2008; Lakhal 2011). The goal of the present study was to compare two systems for the isolation of oral operating areas, namely rubber dam (RD) and IsoLite (IL) during a 5 min sham periodontal therapy treatment. The results show that both systems allowed for some, if minimal, leakage. Further, the subjects in this study rated both systems as rather comfortable to wear. Therefore, our hypothesis could only be partially accepted.

The dental dam was invented in 1864 by Dr. Sanford Christie Barnum (Winkler 1991) and is considered to be the gold standard to provide a dry operation field and to protect cheek and the tongue of noxious contact with burs. In the middle of the 19th century, the dental dam was a groundbreaking innovation and allowed for a dry operation field for the first time. However, in this context, practicable and affordable suction systems were not available for supportive use. In spite of this, the dental dam became widely used, also in Europe. Over the course of the 20th century, suction systems reached a sufficient technical level and became widely popular in many dental offices. As a consequence, dentists questioned the persisting need for the use of dental dam. Additional problems such as material durability (brittleness over time), and latex allergies, were quickly

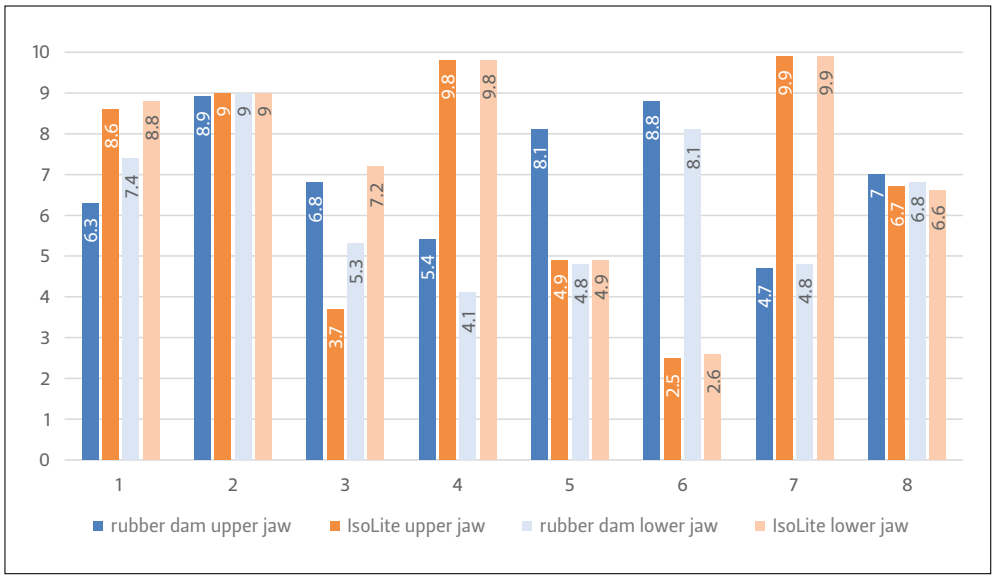

Fig. 4 Individual patient satisfaction (bar charts; VAS 0–10) after treatment in the upper and lower jaw.

responded to by the latex industry with technical innovations and the usage of other material compositions.

Today the most commonly used method (and current "gold standard") for isolating the operation field in dentistry is by use of the RD. In general, it is easy to apply, inexpensive and considered to be a secure method to maintain a dry operation field. Only a few instruments are necessary to achieve what is considered to be an adequate and safe isolation result: a clamp, floss or wedges and/or tissue glue. In this study, an experienced clinician who was familiar with RD usage performed the RD fixation. However, (perceived) additional time was required for the application of the tissue glue in this method, which represents a disadvantage of the use of RD in the non-surgical treatment of periodontal disease. In general, the RD placement is affected by the experience of the operator (Kapitan et al. 2014). Some subjects presented with oral characteristics that made it necessary to dry the gingiva multiple times, either due to quick wetting (saliva) before glue application or because the volunteer pushed the RD away with the tongue. Even for experienced clinicians, drying of the gingiva and gluing can be challenging. For clinicians with less experience, it might therefore be difficult and time-intensive to achieve a reliable isolation of the operation field using this particular RD technique. Depending on the anatomical variance of the jaw and amount of saliva production, even the highly skilled clinician was not able to completely seal all gaps and parts of the RD around the clamp. Unconsciously, all participants ejected saliva or swallowed a part of the irrigation water. The obtained results must therefore be interpreted with caution.

The placement of the soft plastic IL mouthpiece was in most cases easy to achieve. In all cases it was performed in less than (perceived) one minute. Even if the mouthpiece had to be changed due to miscalculation of size, the overall time needed for placement was perceived to be short – shorter than mounting and fixing RD with Histoacryl.

As the results of this study show, neither method of isolation provided a perfectly dry field. This is in line with earlier studies (Kapitan et al. 2014, 2015) that have analyzed low level RD leakage. That the IL provided isolation values similar to this accepted "gold standard" isolation technique is encouraging. As the results of the current study have made clear, subject preference and, though only incidentally reported, (perceived) operator application time for isolating systems are also important factors for consideration.

The observed net leakage gains due to saliva entering the dry field area may have been caused by a number of issues: clamps that were not perfectly seated (though not obvious), individual subjects' saliva production (abnormally high), imperfectly sealed (though not obvious) rubber dams, imperfect fit of the IL mouthpiece (jaws with difficult anatomy) and reduced IL isolation when subjects did not firmly bite on the bite block. By releasing the load on the bite block, a small gap may have been created between mouthpiece and gingiva, which could have led, retrospectively, to leakage. The larger amounts of leakage recorded for subject number 4 may also be explained by exaggerated tongue movement dislodging the isolation systems, which allowed for pushing saliva into the isolation field. While the values for this subject were higher for IL – which could be more easily moved – they were concurrently higher for RD as well.

A further limitation of the study was that no real debridement was performed but only a sham treatment. The protocol was devised to maximize potential collection results. Pressure and tension, which could have affected the isolation characteristics of the systems tested, were avoided. Therefore, the application of an irrigant could be simulated in an easier and more controllable way, i.e. controlled for time, force and amount of water equally in both systems. Also, aerosol formation, a possible source of irrigant loss, was not measured. However, any such loss must be assumed to be equal for all sham treatments. Therefore, the role that aerosol formation plays when evaluating the isolation systems was not considered relevant for interpreting the results.

In addition, the present study design reports on a very short treatment time of 5 minutes only. Periodontal treatments, however, as described by Sahrmann et al. (2014), calculated 1 minute for each tooth. Therefore, the results for patients' satisfaction have to be viewed in this light. While other studies (Collette et al. 2010; Alhareky et al. 2014) have also shown the patients' satisfaction after only a short treatment time (maximum of 20 minutes), further studies with longer treatment times may be required to generate more clinically relevant

data – also for patient satisfaction. Within the current volunteer-based convenience sample, this was, however, not feasible.

At roughly 10% leakage, both of the tested isolating systems provided a sufficient seal and evacuation capability to prevent patients from swallowing potentially toxic amounts of antimicrobial liquids such as PVP-I. A literature search revealed that toxicological data for the oral ingestion of PVP-I are still scarce. Based on our results, and an up calculation of treatment time to 50 min, both systems should still provide a sufficient isolation performance (10 × 5 min results = 10 × 34 ml [max. loss] = 340 ml of swallowed liquid potential). This would still be below the given toxicity level. According to the National Center for Biotechnology Information of the U.S. National Library of Medicine (https://pubchem.ncbi.nlm.nih.gov), the oral LD50 for rats is 8,000 mg/kg. There were no such data for humans provided. However, in case of swallowing an estimated 340 ml, patients would remain well below the risk level for serious medical problems (i.e. for a patient weighing 75 kg, the lethal dose would be approximately 600,000 mg).

Conclusions

RD and IL were equally efficacious in preventing leakage under the conditions tested. While neither system provided 100% isolation, both may adequately prevent swallowing noxious amounts of antimicrobials during non-surgical periodontal treatment. The IL isolation system was easy to handle, probably even for clinicians with less experience, while providing similar isolation values as RD. Further, there may be some advantage to the built-in bite block to both patients and clinicians over longer treatment times, however this must be tested in further studies.

Conflict of Interest and Sources of Funding Statement

Financial support for this study was provided by the authors' institution. An IsoLite system was provided for use in this study by the local distributor, however they were given no access to the results reported here before publication.

Zusammenfassung

Einleitung

Die wiederholte Anwendung hoch konzentrierter antimikrobieller Substanzen während des Debridements kann im Falle des Schluckens derselben problematisch werden. In diesem Bericht wurden zwei verschiedene Varianten der Trockenlegung untersucht.

Materialien und Methoden

Acht Freiwillige nahmen an diesem Versuch teil. Es wurde zufällig festgelegt, ob Kofferdam (RD) oder das IsoLite-System (IL) auf der rechten oder linken Seite im Ober- resp. Unterkiefer übers Kreuz appliziert wurden. Der Kofferdam wurde zwischen Eckzahn und erstem Molaren eingeschnitten, über den ersten Molaren gestülpt und mit einer Klammer fixiert. Zwischen den beiden Zähnen wurde die Gingiva getrocknet und der Kofferdam mit einem Gewebekleber (Histoacryl) fixiert. Das IsoLite-System wurde gemäss Herstellerangaben der Mundgrösse entsprechend ausgewählt und im Mund eingebracht. Mit einem Ultraschall-Zahnsteinentfernungsgerät wurde unter kontinuierlicher Wasserspülung während fünf Minuten eine Parodontalbehandlung simuliert. Das vor der Behandlung gewogene Spülwasser wurde aus dem Kofferdam resp. durch das IL abgesaugt und in einem speziellen Auffangglas gesammelt. Die Differenz zwischen Ausgangsgewicht und Auffanggewicht gab Aufschluss über die Dichtigkeit der Trockenlegungssysteme. Zusätzlich wurden nach der «Behandlung» die Testteilnehmer unter Verwendung einer VAS-Skala gefragt, wie angenehm die beiden Trockenlegungsvarianten waren.

Ergebnisse

Keine der beiden getesteten Trockenlegungsvarianten war vollständig dicht. Bei beiden Varianten wurde etwas mehr Durchlässigkeit im Oberkiefer festgestellt. Generell konnte jedoch festgehalten werden, dass die Durchflussraten sowohl für RD wie auch für IL gering waren. Im Durchschnitt flossen bei beiden Systemen ca. 10% des Spülmittels in den Mund. Im Oberkiefer geriet Spülwasser bei vier Patienten unter dem RD in den Mund; unter Verwendung des IL geschah dies bei sechs Patienten. Im Unterkiefer wurden mit beiden Systemen gleich gute Werte erzielt; nur je dreimal gelangte Flüssigkeit durch die entsprechende Trockenlegung in den Mund. Beide Systeme boten einen mässig angenehmen Tragekomfort: Die gemessenen VAS-Werte für RD beliefen sich auf 7,1 und bei IL auf 6,6. Dass unter IL je nach individueller Anatomie die Zunge gegen den Rachen gedrückt und somit der Würgereflex ausgelöst werden konnte, wurde von einigen Probanden negativ angemerkt. Da die simulierte Behandlung nicht unter Lokalanästhesie durchgeführt wurde, empfanden andere Testpatienten den Druck der Kofferdamklammer als eher unangenehm.

Diskussion

Es kann festgehalten werden, dass sowohl RD als auch IL verhindern konnten, dass Spülflüssigkeit in grösseren Mengen in den Mund gelangte. Nicht perfekt abgedichtete, verklebte Stellen rund um die Kofferdamklammer und anatomische Gegebenheiten v.a. des Gaumens und daher eine insuffizient adaptierte Gummilippe des IL führten wohl zu durchlässigen Stellen. Beide Systeme zeigten Vorteile (Zeitersparnis für IL und tiefere Kosten für RD), aber auch Nachteile (Würgereflex bei IL und Schmerzen durch die Kofferdamklammer für RD). Die Applikation des Kofferdams inkl. Trockenlegung und Verklebung schien nur für geübte Klinker geeignet. Das Einbringen des IL hingegen kann auch für Ungeübte als einfach und für den Patienten als Schutz angesehen werden. Limitierend an dieser Studie ist die Tatsache, dass keine effektive Behandlung durchgeführt wurde. Damit wurde kein Druck auf den RD oder das IL ausgeübt, was gegebenenfalls zu grösserer Durchlässigkeit hätte führen können.

Résumé

Introduction

L'utilisation répétée d'agents antimicrobiens hautement concentrés au cours du débridement peut être problématique en cas d'ingestion. Dans ce travail, deux techniques différentes de mise à sec ont été investiguées.

Matériel et méthodes

Huit volontaires ont participé à cet essai. Il a été déterminé de façon aléatoire si la digue ou le système IsoLite (IL) seraient appliqués en croix sur le côté droit ou gauche de la mâchoire supérieure ou inférieure. La digue était incisée entre la canine et la première molaire, glissée sur la première molaire et fixée avec un crampon. Puis la gencive était séchée entre les deux dents et

la digue était fixée avec un adhésif tissulaire (Histoacryl). Selon les indications du fabricant, le système IsoLite était choisi en fonction de la taille de la bouche, puis inséré en bouche. Un détartreur à ultrasons a été utilisé pour simuler un traitement parodontal sous rinçage à l'eau continu pendant cinq minutes. L'eau de rinçage pesée avant le traitement était aspirée de la digue ou du système IL et recueillie dans un récipient spécial pour la collecte du liquide. La différence entre le poids initial du récipient et le poids après la collecte du liquide a donné des informations sur l'étanchéité des systèmes de mise à sec. Après le «traitement», les participants au test ont indiqué en outre, à l'aide d'une EVA, dans quelle mesure les deux variantes de drainage avaient été «agréables».

Résultats

Aucune des deux variantes de mise à sec testées n'a été complètement étanche. Dans les deux variantes, les fuites détectées ont été un peu plus importantes dans la mâchoire supérieure. De manière générale, il a cependant été constaté que le débit des fuites était faible, aussi bien pour le système digue que pour le système IL. En moyenne, pour les deux dispositifs, environ 10% du liquide de rinçage s'est écoulé dans la bouche. Pour la mâchoire supérieure, l'eau de rinçage est parvenue dans la bouche de quatre patients avec digue; avec IL, cela s'est produit chez six patients. Pour la mâchoire inférieure, des résultats équivalents ont été obtenus avec les deux systèmes; dans chacun des deux groupes, le liquide est parvenu dans la bouche de seulement trois volontaires après avoir traversé le système de mise à sec. Le port de chacun de ces deux systèmes a été modérément agréable. Les valeurs moyennes obtenues avec l'EVA ont été de 7,1 pour le groupe digue et de 6,6 pour le groupe IL. Avec le système IL et selon l'anatomie individuelle, la langue peut être poussée vers le pharynx, ce qui peut déclencher un réflexe nauséeux – un fait qui a été noté négativement par certains sujets. Comme le traitement simulé n'était pas effectué sous anesthésie locale, d'autres personnes testées ont trouvé la pression de la pince de la digue plutôt désagréable.

Discussion

Il est permis de conclure que le liquide de rinçage ne parvient pas en grande quantité dans la bouche, ni avec le système digue, ni avec le système IL. Certaines zones collées mais imparfaitement scellées autour de la pince de la digue ainsi que des particularités anatomiques, surtout au niveau du palais et entraînant une adaptation imparfaite de la lèvre en caoutchouc, expliquent sans doute la présence de sites non étanches. Les deux systèmes ont des avantages (gain de temps avec IL et réduction des coûts avec digue), mais aussi des inconvénients (réflexe nauséeux avec IL et douleur due à la pince de la digue). L'application de la digue, y compris la mise à sec et le collage, ne semble convenir qu'aux cliniciens expérimentés. Cependant, l'insertion du dispositif IL peut être considérée comme aisée, même sans entraînement, et permet de protéger le patient. Le facteur limitant de cette étude est le fait qu'un traitement effectif n'a pas été réalisé. Ainsi, aucune pression n'a été exercée sur le dispositif digue ou IL, ce qui aurait pu conduire, le cas échéant, à des fuites plus importantes.

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